Assignment 2

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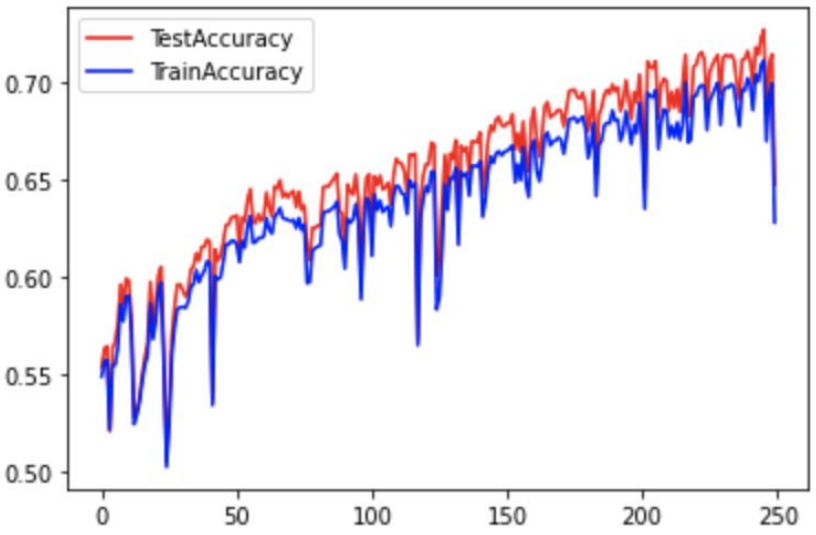
Deep Learning: Assignment 2
Date: 05/16/2020

1. **Apply the normalization on the training and test data**

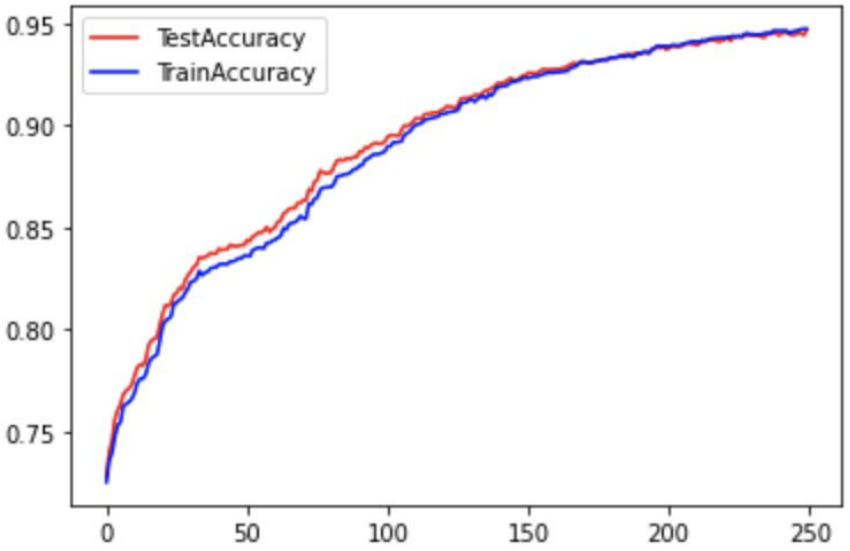
```
x_train  = (x_train - np.mean(x_train, 0))/ np.std(x_train, 0)
x_train[np.isnan(x_train)] = 0

x_test =  (x_test - np.mean(x_test, 0))/ np.std(x_test, 0)
x_test[np.isnan(x_test)] = 0
x_test[np.isinf(x_test)] = 0

x_train = np.hstack((x_train, np.ones((x_train.shape[0], 1), dtype=x_train.dtype)))
x_test = np.hstack((x_test, np.ones((x_test.shape[0], 1), dtype=x_test.dtype)))
```

2. **As a baseline, train a linear classifier yˆ = v T x and quadratic loss. Report its test accuracy**
   After running the code for linear classifier and finding the quadratic loss, test accuracy came out to be: 85.57%

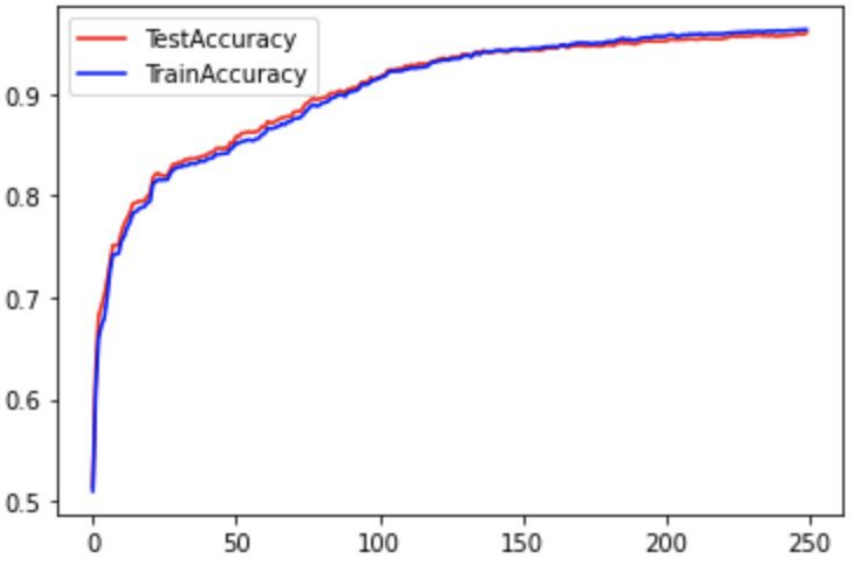
3. **Learning rate = 0.0001**
   For k=5:



For k=40:



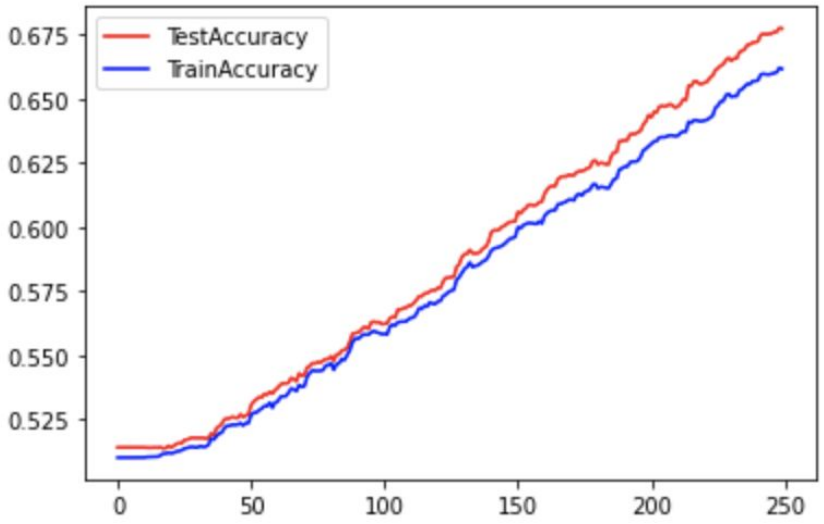
For k=200:



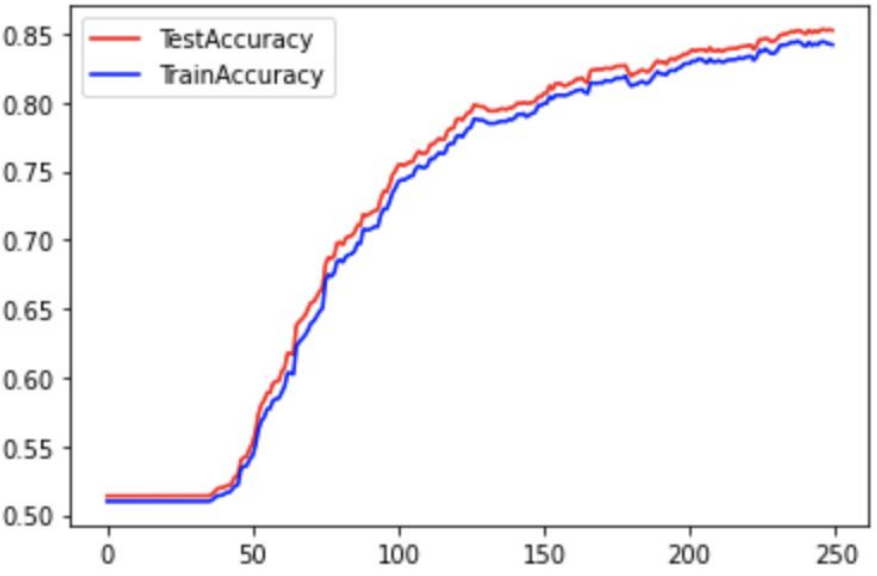
Comment on the role of hidden units k on the ease of optimization and accuracy

For k=5, both the train and the test accuracy is low and has a lot of zig zag pattern. From the above plots, as k increases, the train and the test accuracy increases.

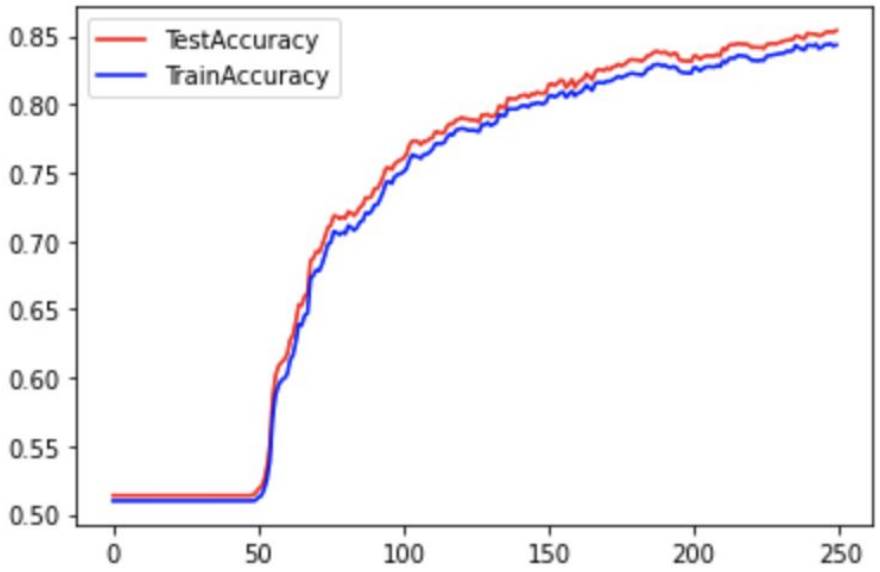
4. **Learning Rate = 0.0001**
   For k=5:



   For k=40:



For k=200:



Comment on the role of hidden units k on the ease of optimization and accuracy
As k increases, the train and the test accuracy increases and hence the ease of optimization increases.

5. **Comment on the difference between linear model and neural net. Comment on the differences between logistic and quadratic loss in terms of optimization and test/train accuracy**

    a. The neural net contains hidden layers which get used for better feature abstraction. Also, as the neural net due to its design gives a non-linear boundary, whereas in the case of linear model, as the name suggests, gives a linear boundary. Considering the given data, the neural net performs better as compared to the linear model due to its non-linear decision making.
    b. The logistic loss converges faster than the quadratic loss. The logistic loss takes much less time to calculate as compared to quadratic loss.